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UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Project	Date	Author

TITLE

A WORKING PLAN FOR A STUDY OF CLIMATIC INFLUENCES ON INSECT LOSSES IN THE PONDEROSA PINE TYPE OF NORTHERN CALIFORNIA

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and
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Berkeley, California
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SUBJECT—

INDEX NO.—

A WORKING PLAN FOR A STUDY OF CLIMATIC INFLUENCES ON INSECT LOSSES IN THE PONDEROSA PINE TYPE OF NORTHERN CALIFORNIA

By Ralph C. Hall, Assistant Entomologist
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I. OBJECTIVE:

The purpose of the study is to determine the important climatic and other ecological factors affecting the activities of forest insects causing timber losses in the ponderosa pine type of northeastern California.

II. SCOPE:

The initial work on this problem will of necessity be exploratory in nature. For this reason it is proposed to:

1. Test instruments and methods for measuring the various climatic factors in stands of different degrees of insect hazard as classified by the Forest Insect Hazard Inventory.
2. Evolve a technique for following the development of broods and sampling bark beetle populations.
3. Test small plots for sampling timber losses.
4. Make a preliminary study of tree growth.

III. METHOD OF STUDY:

The proposed study will be carried out by collecting such data as appears to be pertinent to the problem by means of instrumentation, observation, and laboratory analysis.

1. Instrumentation.

   Climatic and other ecological factors will be measured by standard instruments and techniques developed for such purposes. In so far as possible, standard Weather Bureau specifications will be followed in setting up weather stations.

2. Bark beetle broods and populations.

   Studies will be made of bark beetle broods and populations by observations and counts on infested trees in the field and caged material at the laboratory.

3. Sampling timber losses.

A study of sampling timber losses will be initiated by the use of small plots of 20 acres in size distributed in proportion to Hazard Zones over the Burney Area.

4. Tree growth.

Diameter growth records will be obtained through the use of increment cores for past growth and tree bands and dendrographs for current growth. Periodic height measurements will be made on reproduction during the growing season.

IV. THE LOCATION OF THE STUDY.

This study will be located in Shasta County in the Burney Area as designated in Johnson's recent insect hazard classification. This area of approximately 250,000 acres is bordered on the south by the Lassen National Park; on the east by the Hat Creek Lava Rim; on the north by Pitt River and Lake Britton; and on the west by a ridge extending from Hatchet Mountain, Clover Mountain and Table Mountain. The headquarters for the study will be located at the Hat Creek Field Laboratory at Hat Creek.

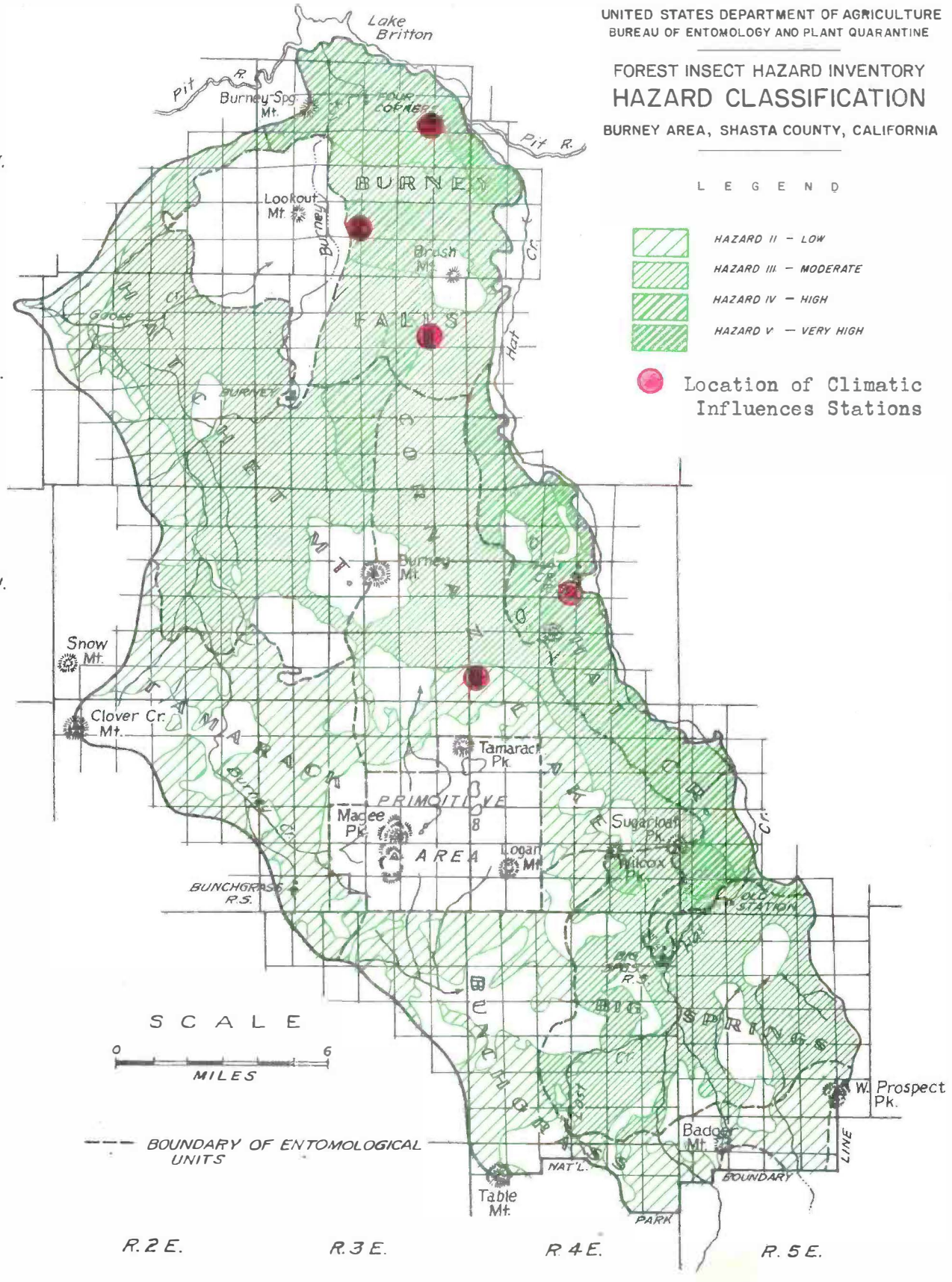
A weather station to measure the various climatic influences will be established in each of four different hazard areas throughout the growing season for tree growth and the period of insect activity. In addition, a complete weather station will be established and maintained at the Hat Creek Laboratory for continuous all-year records. The stations will be designated as follows: Warner Bridge, in a Hazard V area located in Section 11, township 36 N, range 3 E; Blue Lake, in a Hazard IV area located in section 28, township 36 N, range 3E; Burney Flat, located in section 22, township 35 N, range 3 E; Cornaz Lake, located in section 31, township 34 N, range 4 E; and Hat Creek, located in section 15, township 34 N, range 4 E. (See map.) A 20 acre permanent sample plot will be located at each weather station.

The areas to be used in this study have been selected as uniform as possible in all respects except insect hazard. All areas are essentially level, of pure pine composition, and with the exception of Cornaz Lake, all are at the same elevation, 3,100 feet. The Cornaz plot is at 4,600 feet.

V. MEASUREMENT OF FACTORS.

1. Climatic Factors.

During the 1939 season of insect activity, observations will be taken at weekly intervals on each Monday, at which time all recording charts will be changed and various instruments checked for accuracy. During the period when insects are inactive, winter and early spring, precipitation records only will be taken except at the main Hat Creek Station.


UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
FOREST INSECT HAZARD INVENTORY
HAZARD CLASSIFICATION
BURNEY AREA, SHASTA COUNTY, CALIFORNIA
LEGEND
HAZARD II – LOW
HAZARD III. – MODERATE
HAZARD IV – HIGH
HAZARD V. – VERY HIGH
Location of Climatic Influences Stations
Lake Britton
Pit R.
Burney Spg. Mt.
FOUR CORNERS
Pit R.
T. 36 N.
BURNEY
Lookout Mt.
Burney Cr.
Brush Mt.
Hat Cr.
Goose Mt.
FALLS
T. 35 N.
BURNEY
Burney Mt.
Snow Mt.
Clover Cr. Mt.
Tamarack Pk.
T. 34 N.
PRIMOITIVE
AREA
Magee Pk.
Logan Mt.
Sugarloaf Pk.
Wilcox Pk.
OLD STATION
BUNCHGRASS R.S.
T. 33 N.
SCALE
0 6
MILES
BOUNDARY OF ENTOMOLOGICAL UNITS
W. Prospect Pk.
Badger Mt.
NAT'L.
BOUNDARY
LINE
Table Mt.
PARK
T. 32 N.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.

A. Temperature. Air temperature records will be obtained from a hygro-thermograph and standard U. S. Weather Bureau maximum and minimum thermometers installed at each station.

B. Moisture.

(1) Relative humidity. Air relative humidity will be obtained from the hygro-thermograph which will be checked periodically by a Rogers type, in place, psychrometer of a fan type.

(2) Precipitation. Rainfall will be measured by use of the standard Fire Weather Study rain gage. A small amount of light machine oil S.A.E. #20 will be placed in the bottom of each gage to prevent evaporation between periods of reading.

Snowfall will be measured in three ways; first by use of a snow gage approximately 14" x 4' which will be equipped with slat shields to reduce error due to eddying, second by use of graduated snow sticks in place installed at 5 different places on the 20 acre sample plot, third by the use of the standard Weather Bureau snow sampler.

(3) Evaporation. Evaporation will be measured by use of a standard weather bureau open pan, with levels measured by a hook gage, together with the newly designed Bates evaporimeter.

C. Light. A simple sunshine recorder will be used to record duration of full sinlight during each day.

D. Wind. Wind movement will be recorded in miles per hour on a recording type of anemometer such as has recently been designed by the Dozier Manufacturing Co. of Berkeley.

2. Edaphic Factors

A. Temperature. Soil temperatures will be obtained at each station by use of three maximum and minimum soil thermometers inserted at three different levels, ¼". 3" and 7", and by the use of a recording Foxboro thermometer at one depth. In addition, a Friez, three pen soil temperature recording thermograph will be used at the Hat Creek Station to obtain trends for temperatures at various depths.

B. Moisture. Soil moisture will be obtained by taking small samples of approximately 100 grams at depths of surface to 3", 6" to 8", and 11 to 13", and 18 to 20". Weekly samples at depth 6 to 8" and monthly samples of all four depths will be taken. Eight samples each will be randomly selected for each period from each 20 acre permanent plot. The samples will be oven dried at a constant temperature of 105°C for a 24 hour period and the moisture content will be expressed as a percentage on the basis of the net dry weight. In addition the soil moisture balance will be obtained by the use of a

Loudermilk lysimeter from which it will be possible to determine the run off, seepage, and evaporation from soils in place.

C. Wilting coefficient will be determined for the soils at each station by standard laboratory procedure using sunflower plants. Moisture field capacity will also be determined.

D. Physical properties. Gross physical properties will be determined for each soil.

3. Biotic Factors

A. Insect populations and trends. A study will be made of each western pine beetle brood throughout the season on each weather station area. Counts will be made of attack-emergence ratio for each brood to determine if this factor is tied in with climatic effects. Also there appears, from past loss records for about a 15 year period, that there is a definite cyclic response in western pine beetle losses. By following the development of each brood and generation over a period of years it will be possible to determine if a cyclic response does exist.

4. Plant Physiological Factors

A preliminary study of past tree growth from increment cores will be initiated on all weather station areas.

In addition, a study will be conducted on current periodic diameter and height growth on selected trees on each plot.

Phenological records will be initiated during the current season. These records will be obtained from all dominant plant species on each area. Each plant will be numbered and located on the permanent sample plot for easy future reference.

5. Sampling Timber Losses Caused by Insects

The climatic influences stations have been set up to sample these factors on small areas in each of four hazard zones. As losses occurring on these small units are likely to be highly variable, it will be necessary to sample losses throughout each hazard zone on a more reliable basis.

As the Burney area is at present not sampled for losses except by Shasta Survey Plot No. 8, it is planned to put in a series of permanent research and survey plots to give the needed information on losses. A preliminary sampling study

of insect caused losses in the ponderosa pine type in the eastside has demonstrated the theoretical high efficiency of 20 acre plots compared to those of 320 acres. For that reason a series of 50 twenty acre sampling units will be installed in the Burney Area. These will be more or less randomly assigned to the different hazard zones in proportion to the percentage of the total area occupied by each hazard. This assignment will be as follows: Hazard II, 15 plots; Hazard III, 23 plots; Hazard IV, 11 plots; and Hazard V, 1 plot. Ten of these plots will be intensive research plots and the balance will be principally for survey purposes. This plot establishment program will include complete time studies on all phases of plot establishment, including travel, boundary survey and marking, tree tally and classification, height measurement and general plot classification.

A. Research plots. Five of the research plots will be located in the close proximity of the Climatic Influences study areas. These plots will have priority and will be established as soon after July 1 as possible.

The dimensions of the 20 acre plot will be 10 x 20 chains. Each master plot will be subdivided into 8 sub-plots 5 x 5 chains, or 2.5 acres each. These 2.5 acre sub-plots will be referred to the south east corner of the plot. Whereever possible these plots will coincide with land subdivision lines and will be tied in accurately to the nearest section corner as well as a tie to the nearest road or trail. In addition a plot location map will be prepared for each plot showing its location with reference to township, range, and section, and its accessibility with reference to roads and trails. Two markers will be placed on the road or trail from which the plot may be reached, with information on the marker as to the direction and distance to at least one plot corner. These markers will be placed so that they can be readily seen when approaching from either direction on the road or trail.

The four main corners of the plot will be designated with a wooden post of 4 x 4" dimension and approximately 4 feet above the level of the ground. The corners of the sub-plot will be designated by wooden posts 2 x 2" in diameter and approximately 3 feet above the ground level. All corner posts will be painted an orange color so as to render them more conspicuous. The four main corners will be marked by a metal plot designation sign recently adopted.

All outside boundary lines will be brushed out and indicated by orange paint splashes on line trees.

A topographic map will be prepared for each plot.

(1) Data to be taken on each sub-plot.

Percent of slope - obtained from the topographic map.

Aspect - cardinal direction which the slope faces.

Elevation.

Soil source - volcanic or other.

Soil character - gross characteristics.

Forest type - following Forest Service standards.

Site classification - based upon measurements of young or immature dominant trees.

Reproduction tally - probably obtained from a line tally such as is used by Hasel.

Pole tally - by species by 2" diameter classes.

(2) Merchantable tree data.

The following data will be obtained for each tree over 11.6" d.b.h.

Diameter - to nearest tenth inch.

Height of enough trees to give a smooth curve.

Keen Tree Class

Dunning Tree Class

Risk Rating

Notes on topkill - estimated length dead, and condition, whether current, red, black or minus bark.

Numbering all trees over 11.6" will be numbered with paint or a metal tag.

B. Survey Plots. The survey plots will receive the same general treatment as the research plots except that no trees will be numbered.

BUDGET

Salary, Permanent - Hall and Eaton	$5,200.00	
Temporary - 1 man, full year	1,440.00	
" 2 men, 6 months	1,440.00	
Total Salaries		$8,080.00
Travel and Incidentals	$ 700.00	
Equipment, including car replacement	3,000.00	
Total Expenses and Equipment		$3,700.00
TOTAL BUDGET		$11,780.00

Note: The above budget as set up allows for the continuation of the reproduction studies by Eaton allowing about 75 percent of his time for that work during the current field season.

Respectfully submitted,

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Assistant Entomologist

Charles B. Eaton,
Junior Entomologist

Berkeley, California
June 19, 1939